AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application:

Listing of Claims:

1. (Currently Amended) A vestigial sideband (VSB) ~~VSB~~ receiver for receiving signals which are transmitted by being modulated in a vestigial sideband method, comprising:

a digital processing part for selecting a desired channel frequency ~~via an antenna~~ and converting the desired channel frequency to an intermediate frequency to digitize ~~digitalize~~ a predetermined pass band of the intermediate frequency;

a carrier wave restoring part for extracting pilot components from a signal of the digitized ~~digitalized~~ pass band to restore carrier waves;

a demodulator for separating components I and Q from the signal of the digitized ~~digitalized~~ pass band and multiplying the I and Q components with a complex carrier wave~~, which is~~ restored in the carrier wave restoring part, to demultiplex the components I and Q to signals I and Q of a base band; and

a symbol restoring part for restoring a transmission symbol from the signal I of the demodulated base band output from the demodulator.

2. (Currently Amended) <u>The</u> ~~A~~ VSB receiver of claim 1, wherein the digital processing part comprises:

a <u>surface acoustic wave (SAW)</u> ~~saw~~ filter for passing <u>a</u> ~~the~~ predetermined band of the intermediate frequency,

a digital converter for <u>digitizing</u> ~~digitalizing~~ signals which are passed through <u>the</u> ~~a surface acoustic wave~~ SAW filter,

a digital matching filter for passing a band in which information from the <u>digitized</u> ~~digitalized~~ signals exists, and

a phase divider for dividing the components I and Q from the signals which passed through the digital matching filter.

3. (Currently Amended) <u>The</u> ~~A~~ vestigial sideband receiver of claim 2, wherein the SAW filter has a pass band designed widely enough to include all vestigial sideband signals of ~~the~~ middle frequency band.

4. (Currently Amended) <u>The</u> ~~A~~ vestigial sideband receiver of claim 2, wherein the digital converter comprises:

an A/D converter for directly converting an <u>analog</u> ~~analogue~~ IF signal which passed through the <u>SAW</u> ~~saw~~ filter to a digital signal by using a fixed frequency as an input clock, and

a re-sampling part for reducing errors between the signals which are <u>digitized</u> ~~digitalized~~ in the A/D converter by using a timing error of current

symbols which are restored by ~~via~~ the symbol restoring part ~~base band signal processing~~.

5. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 2, wherein the digital converter comprises:

an analog ~~analogue~~ mixer for converting the analog ~~analogue~~ IF signal which passed through the SAW ~~saw~~ filter to a secondary analog ~~analogue~~ IF signal, and

an A/D ~~A/C~~ converter for directly digitizing ~~digitalize~~ the secondary analog ~~analogue~~ IF signal by using VCXO as an input clock.

6. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 1, wherein the carrier wave restoring part comprises:

a pilot extracting part for extracting pilot signals of the components I and Q from the signals of the digitized ~~digitalized~~ pass band,[[.]]

a multiplier for multiplying a complex carrier wave to the extracted pilot signals I and Q to convert to the base band,

a frequency/phase error detecting part for detecting frequency and phase errors from the pilot signals I and Q of the base band,

a loop filter for converting the frequency and phase errors to DC components by filtering, and

a numerical control oscillator for generating a complex carrier wave proportional to the DC components of the loop filter to output to the multiplier and the demodulator.

7. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 6, wherein the pilot extracting part modulates an IIR low band pass filter of a lower degree to sine waves and cosine waves.

8. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 7, wherein the IIR low band pass filter is ~~to be~~ a primary All-pole IIR filter to which following formula is applied:

$$H_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$H_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary All Pole low band pass filter is H(z), $H_r(z)$ and $H_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of H(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, and a is a value for determining a 3-dB band area.

9. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 8, wherein the primary All-pole IIR filter shares a common denominator when designing a filter for extracting pilot components of the component I and a filter for extracting pilot components of the component Q.

10. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 7, wherein the IIR low band pass filter is ~~to be~~ a primary Butterworth IIR filter to which following formula is applied:

$$B_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$B_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary Butterworth IIR filter is B(z), $B_r(z)$ and $B_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of B(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, a is a value for determining a 3-dB band area.

11. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 10, wherein the primary Butterworth IIR filter shares a common denominator when designing a filter for extracting pilot components of the component I and a filter for extracting pilot components of the component Q.

12. (Currently Amended) The ~~A~~ vestigial sideband receiver of claim 6, wherein the frequency/phase error detecting part comprises:

a code detector for detecting codes of pilot signal I which is output from the multiplier,

a delay for delaying the detected code components for N sampling, and

a multiplier for multiplying an output from the delay with pilot signal Q which is output from the multiplier, to output to the loop filter.

13. (Currently Amended) An apparatus for restoring carrier waves of a vestigial sideband receiver for restoring carrier waves by receiving signals which are transmitted by being modulated in a vestigial sideband method and converting the signals to digital signals of a pass band, the apparatus comprising:

a pilot extracting part for extracting pilot signals of components I and Q from signals of digitized ~~the digitalized~~ pass band;

a first multiplier for multiplying a complex carrier wave to the extracted pilot signals I and Q to convert them to a base band;

a frequency/phase error detecting part for detecting frequency and phase errors from the pilot signals ~~I and Q~~ of the base band;

a loop filter for converting the frequency and phase errors to ~~a~~ DC components by filtering; and

a numerical control oscillator for generating a complex carrier wave proportional to the DC components of the loop filter to output to the multiplier and a ~~the~~ demodulator.

14. (Currently Amended) The ~~A~~ carrier wave restoring apparatus of claim 13, wherein the pilot extracting part ~~vestigial sideband receiver~~ modulates an IIR low band pass filter of a lower degree to sine waves and cosine waves.

15. (Currently Amended) The ~~A~~ carrier wave restoring apparatus of claim 14, wherein the IIR low band pass filter is ~~to be~~ a primary All-pole IIR filter to which following formula is applied:

$$H_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$H_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary All Pole low band pass filter is H(z), $H_r(z)$ and $H_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of H(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, and a is a value for determining a 3-dB band area.

16. (Currently Amended) The ~~A~~ carrier wave restoring apparatus of claim 14, wherein the IIR low band pass filter is ~~to be~~ a primary Butterworth IIR filter to which following formula is applied:

$$B_r(z) = s \cdot \frac{1 - a \cdot \cos\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

$$B_i(z) = s \cdot \frac{1 - a \cdot \sin\omega_c z^{-1}}{1 - a \cdot \cos\omega_c z^{-1} + z^{-2}}$$

wherein, if it is assumed that Z-conversion of the primary Butterworth IIR filter is B(z), $B_r(z)$ and $B_i(z)$ are respectively a sine wave modulation signal and a cosine wave modulation signal of B(z), ω_c is a normalised carrier wave frequency, s is a normalisation constant for making a DC gain to be 1, a is a value for determining a 3-dB band area.

17. (Currently Amended) The ~~A~~ carrier wave restoring apparatus of claim 13, wherein the frequency/phase error detecting part comprises:

a code detector for detecting codes of pilot signal I which is output from the multiplier,

a delay for delaying the detected code components for N sampling, and

a second multiplier for multiplying an output from the delay with pilot signal Q which is output from the first multiplier to output to the loop filter.

18. (Currently Amended) A carrier wave restoring method for ~~of~~ a vestigial sideband receiver which receives signals transmitted by being modulated in a vestigial sideband method, and converts the signals to digital signals of a pass band to restore carrier waves, the method comprising the steps of:

(a) extracting pilot signals of components I and Q from signals of digitized ~~the digitalized~~ pass band;

(b) multiplying a complex carrier wave to the extracted pilot signals I and Q to convert them to a base band;

(c) ~~detecting part for~~ detecting frequency and phase errors from the pilot signals ~~I and Q~~ of the base band;

(d) converting the frequency and phase errors to ~~a~~ DC components by filtering; and

(e) generating a complex carrier wave proportional to the DC components to output to the step (b).

19. (Currently Amended) The ~~A~~ carrier wave restoring method of claim 18, wherein in the step (a), ~~is characterized in that~~ an IIR low band pass filter of a lower degree is modulated to sine waves and cosine waves to extract the pilot signals of the components I and Q.

20. (Currently Amended) The ~~A~~ carrier wave restoring method of claim 18, wherein the step (c) includes the sub-steps of:

detecting codes of pilot signal I which is output from the step (b),

delaying the detected code components for N sampling, and

multiplying an output from the delaying step with pilot signal Q which is output from the step (b), to output to the step (d).

21. (New) The VSB receiver of claim 1, wherein the carrier wave restoring part generates the complex carrier wave proportional to frequency and phase errors associated with pilot signals of the base band.